ECE 595: Learning and Control
Syllabus

Dr. Oishi

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Instructor

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ECE 134C, (505) 277-0299
Office hours: Monday 11am-1pm, via Zoom link available in UNM Learn

Course Location and Time

Online offering, remote scheduled for Friday 12pm-1pm

Course Description

This advanced graduate course will cover recent advances in the interaction of machine learning and control theory. Topics covered will include data-driven optimization for dynamical systems, statistical learning for dynamical control systems, foundations of learning of dynamical models, optimization for machine learning, and data-driven optimization for dynamical systems.

Prerequisites

No prerequisites. Due to the interdisciplinary nature of the subject matter, the course will be self-contained. However, familiarity with linear dynamical systems, differential equations, and linear algebra will be helpful. Reference materials will be provided for review.

Reference Materials

A variety of reference materials will be used, including survey papers, research papers, publicly available presentations by researchers in the area, and textbook chapters. Materials will be selected during the term, based on student interests.

The following textbook is recommended as an introduction to machine learning.

- *Machine Learning Refined*, J. Watt, R. Borhani, and A. Katsaggelos. Cambridge University Press, 2020.

Grading

30% Presentations
30% Class participation
30% Paper summaries
10% Paper review

- **Presentations:** Every student is expected to present at least one paper during the semester. Presentations should address the following questions:
  - Problem statement: What problem does the paper address, and why is it important?
  - Literature survey: How does this paper fit into the context of prior work?
  - Main result: What is the main result of the paper? What is the key idea that the paper focuses on?
  - Technical tools: What is the main technical contribution of the paper?
  - Points of confusion: What technical or conceptual arguments, if any, are unclear or incomplete?
  - Areas for improvement: What flaws does the paper have? What are possible directions for future work to address them?
- **Paper review:** Students will be asked to provide a technical review of at least one paper during the semester. The paper will be chosen in consultation with Dr. Oishi or the student's research supervisor. The review should cover standard elements, such as
  - Novelty
  - Technical depth and soundness
  - Potential impact and relevance
  - Experiment or numerical validation
  - Literature review
- **Class Participation:** In lieu of a traditional lecture, classes will be discussion-based and focused on specific research papers. The participation grade will be based on engagement and meaningful contribution to the discussion.
- **Paper summaries:** For each paper, students will submit a brief paragraph prior to class summarizing their understanding of the paper as well as any outstanding questions. This will help ensure preparedness for the discussion, and facilitate class participation.